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09/749,405	12/28/2000	Stephan J. Jourdan	2207/7085	5261

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EXAMINER

LI, AIMEE J

ART UNIT	PAPER NUMBER
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2183

DATE MAILED: 05/31/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/749,405

Applicant(s)

JOURDAN ET AL.

Examiner

Aimee J. Li

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 March 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-15 and 17-27 is/are rejected.
- 7) ☒ Claim(s) 9 and 16 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-27 have been considered. Claims 1 and 17 have been amended as per Applicant's request.

Papers Submitted

2. It is hereby acknowledged that the following papers have been received and placed of record in the file: Amendment as filed on 21 March 2005 and 1 Month Extension of Time as filed on 21 March 2005.

Allowable Subject Matter

3. Claims 9 and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 24-26 are rejected under 35 U.S.C. 102(b) as being taught by Tran, U.S. Patent Number 5,822,575 (herein referred to as Tran).
6. Referring to claim 24, Tran has taught a method for restoring a branch prediction apparatus following a branch misprediction of a branch instruction, comprising:

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- a. Restoring a base misprediction history register (Tran column 14, line 14 to column 15, line 7; column 18, lines 44-62; column 19, lines 31-49; Figure 3; and Figure 4); and
 - b. Restoring a branch predictor history register (Tran column 14, line 14 to column 15, line 7; column 18, lines 44-62; column 19, lines 31-49; Figure 3; and Figure 4).
7. Referring to claim 25, Tran has taught updating a branch predictor (Tran column 14, line 14 to column 15, line 7; column 18, lines 44-62; column 19, lines 31-49; Figure 3; and Figure 4).
8. Referring to claim 26, Tran has taught updating a meta predictor (Tran column 14, line 14 to column 15, line 7; column 18, lines 44-62; column 19, lines 31-49; Figure 3; and Figure 4).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-8, 10-15, and 17-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang, Hao, and Patt's "Alternative Implementations of Hybrid Branch Predictors" (herein referred to as Patt) in view of McFarling's "WRL Technical Note TN-36: Combining Branch Predictors" (herein referred to as McFarling).

11. Referring to claim 1, Patt has taught a branch prediction apparatus, comprising:
- a. A meta predictor to receive as inputs an index value and a branch prediction to generate a misprediction value in accordance with said inputs (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph

3; and Figure 2); and

- b. A logic gate to receive said branch prediction and said misprediction value to generate a final prediction (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

12. Patt has not taught a base misprediction history register to provide an output. McFarling has taught a base misprediction history register providing an output (McFarling page 12, paragraph 2). In regards to McFarling, the counter is similar to the misprediction history register, since it contains data related to past mispredictions. A person of ordinary skill in the art at the time the invention was made would have recognized that the counter tracks which predictor is more accurate, thereby ensuring the combined branch predictor picks the best predictor to use and reducing mispredictions which cost time. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the misprediction history register of McFarling in the device of Patt.

13. Referring to claim 2, Patt has not taught wherein said base misprediction history register includes misprediction history data. McFarling has taught wherein said base misprediction history register includes misprediction history data (McFarling page 12, paragraph 2). In regards to McFarling, the counter is similar to the misprediction history register, since it contains data related to past mispredictions. A person of ordinary skill in the art at the time the invention was made would have recognized that the counter tracks which predictor is more accurate, thereby ensuring the combined branch predictor picks the best predictor to use and reducing mispredictions which cost time. Therefore, it would have been obvious to a person of ordinary

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skill in the art at the time the invention was made to incorporate the misprediction history register of McFarling in the device of Patt.

14. Referring to claim 3, Patt has taught an instruction that provides said index value (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

15. Referring to claim 4, Patt has taught wherein said instruction is a branch instruction (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2)

16. Referring to claim 5, Patt has taught wherein said final prediction determines a branch for said branch instruction (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

17. Referring to claim 6, Patt has taught a branch predictor that receives said index value and generates said branch prediction (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

18. Referring to claim 7, Patt has taught wherein said branch predictor utilizes a prediction scheme to generate said branch prediction (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

19. Referring to claim 8, Patt has taught wherein said branch predictor includes a target address field and a prediction table (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

20. Referring to claim 10, Patt has taught a method for predicting branches, comprising:

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- a. Receiving an index value and a branch prediction value correlating to said index value at a meta predictor (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2); and
- b. Generating a misprediction value at said meta predictor (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

21. Patt has not taught a misprediction history value. McFarling has taught a misprediction history value (McFarling page 12, paragraph 2). In regards to McFarling, the counter is similar to the misprediction history register, since it contains data related to past mispredictions. A person of ordinary skill in the art at the time the invention was made would have recognized that the counter tracks which predictor is more accurate, thereby ensuring the combined branch predictor picks the best predictor to use and reducing mispredictions which cost time. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the misprediction history register of McFarling in the device of Patt.

22. Referring to claim 11, Patt has taught generating said branch prediction value at a branch predictor (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

23. Referring to claim 12, Patt has taught receiving an index value at said branch predictor (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

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24. Referring to claim 13, Patt has taught generating a final prediction according to said branch prediction and said misprediction value (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

25. Referring to claim 14, Patt has taught determining a final value, and updating said meta predictor and said base misprediction history register according to said final value (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

26. Referring to claim 15, Patt has taught wherein said updating includes comparing said final value to said branch prediction (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

27. Referring to claim 17, Patt has taught a processor, comprising:

- a. A branch predictor to generate a branch prediction (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2);
- b. A meta predictor to receive an index value, said branch prediction data to generate a misprediction value (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

28. Patt has not taught a base misprediction history register. McFarling has taught a base misprediction history register (McFarling page 12, paragraph 2). In regards to McFarling, the counter is similar to the misprediction history register, since it contains data related to past mispredictions. A person of ordinary skill in the art at the time the invention was made would have recognized that the counter tracks which predictor is more accurate, thereby ensuring the

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combined branch predictor picks the best predictor to use and reducing mispredictions which cost time. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the misprediction history register of McFarling in the device of Patt.

29. Referring to claim 18, Patt has taught a final prediction to correlate to said misprediction value and said branch prediction value (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

30. Referring to claim 19, Patt has taught a logic gate to generate said final prediction (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

31. Referring to claim 20, Patt has taught a computer readable medium having stored a plurality of executable instructions, the plurality of instructions comprising instructions to:

- a. Receiving an index value and a branch prediction value correlating to said index value at a meta predictor (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2); and
- b. Generating a misprediction value at said meta predictor (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

32. Patt has not taught a misprediction history value. McFarling has taught a misprediction history value (McFarling page 12, paragraph 2). In regards to McFarling, the counter is similar to the misprediction history register, since it contains data related to past mispredictions. A person of ordinary skill in the art at the time the invention was made would have recognized that

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the counter tracks which predictor is more accurate, thereby ensuring the combined branch predictor picks the best predictor to use and reducing mispredictions which cost time. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the misprediction history register of McFarling in the device of Patt.

33. Referring to claim 21, Patt has taught an instruction to generate said branch prediction value at a branch predictor (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

34. Referring to claim 22, Patt has taught an instruction to receive an index value at said branch predictor (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

35. Referring to claim 23, Patt has taught an instruction to generate a final prediction according to said branch prediction and said misprediction value (Patt page 252, column 2, paragraph 4; page 255, column 1, paragraph 2 to column 2, paragraph 3; and Figure 2).

Response to Arguments

36. Applicant's arguments filed 21 March 2005 have been fully considered but they are not persuasive.

37. Applicant argues in essence on pages 6-7

...However, throughout these cited sections and in the Patt reference as a whole, there is no teaching suggestion or disclosure of at least a meta predictor to receive as inputs an index value and a branch prediction *to generate a misprediction value* as described in embodiments of the present inventions...

Misprediction value 112 then may be used *to decide whether to reverse the prediction provided by the base predictor, or branch prediction 108,*

The Patt reference does not contain any such reference, teaching or suggestion to the ability to reverse the prediction provided by a base predictor...

38. This has not been found persuasive. Though described in the specification, limiting the term "misprediction value" to specifically have "the ability to reverse the prediction provided by a base predictor" without any support in the claim language for this limitation would be improper. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the misprediction value having the ability to reverse the prediction provided by a base predictor) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

39. Applicant argues in essence on pages 7-8

...there is no suggestion or motivation to combine Patt and McFarling beyond the impermissible use of hindsight...The MPEP requires that the references must suggest making the combinations...

...there is no teaching, suggestion or motivation to combine to be found in the references that adequately form the basis of a proper...rejection...

40. This has not been found persuasive. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include

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knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

41. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, McFarling himself on page 12 has taught that the counters track which predictor is more accurate and helps to select which is the best predictor to use. A person of ordinary skill in the art would recognize that having to recover from a branch misprediction is costly in terms of time and resources. The counters aid in selecting which branch predictor to use based on each branch predictor's accuracy and is advantageous by reducing branch mispredictions since the branch predictor with the highest accuracy will be chosen based on the counters.

42. Applicant's argue in essence on pages 8-9

...Applicants respectfully submit that there is no teaching suggestion or disclosure of a "base misprediction history register" as described in the embodiment of claim

24...Support for this limitation can be found, among other places, at page 6 line 16 of the specification, which states:

As discussed above, base misprediction history register 110 reflects the correctness of the base predictor standing alone. Unlike global history registers that record whether previous branches were taken or not taken, base misprediction history register 110 records whether previous branch predictions were correctly predicted by the base predictor.

Applicants respectfully submit that a teaching suggestion of a base misprediction history register as described in embodiments of the present invention is not to be found in any of the cited sections of Tran.

43. This has not been found persuasive. Tran has a misprediction tag and branch tag shift that operate similarly to the misprediction register, since there is a signal as to whether the branch has been mispredicted or not and the branch shift register is updated accordingly so that it contains data about whether past branches were mispredicted or not. Though described in the specification, limiting the term “base misprediction history register” to specifically to recording “whether previous branch predictions are correctly predicted by the base predictor” without any support in the claim language for this limitation would be improper. Also, in essence, Tran does this with his branch tag shift, since the register’s data is changed based upon the misprediction tag. In response to applicant's argument that the references fail to show certain features of applicant’s invention, it is noted that the features upon which applicant relies (i.e., the base misprediction history register “records whether previous branch predictions are correctly predicted by the base predictor”) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Conclusion

44. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

45. A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO**

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MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

46. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aimee J. Li whose telephone number is (571) 272-4169. The examiner can normally be reached on M-T 7:30am-5:00pm.

47. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

48. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AJL
Aimee J. Li
26 May 2005



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